DOCUMENT RESUME

ED 069 880 VT 017 514

AUTHOR	Stroud, Ronald R.; Lamb, Auburn J.
TITLE	Work Measurement in Rehabilitation Workshops.
INSTITUTION	Maryland Univ., College Park. Regional Rehabilitation Research Inst.
SPONS AGENCY	Social and Rehabilitation Service (DHEW), Washington, D.C.
PUB DATE	70
NOTE	25p.; Tech-Monog-1
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Business Administration; Conceptual Schemes; Industrial Education; *Management Systems; *Measurement Techniques; Productivity; Research Projects; *Sheltered Workshops; *Task Performance; Vocational Development; Vocational Education; *Vocational Rehabilitation
IDENTIFIERS	*Work Measurement

ABSTRACT

Partially funded by a research grant from the Department of Health, Education, and Welfare, this technical monograph is the first of a series to be published on production-management aspects of vocational rehabilitation workshops. In order to meet information needs in this area, selected techniques used by industrial profit-making enterprises which are useful for workshops are described. The role of work measurement is discussed in resolving problems associated with the functioning of workshops as both a business and a social service. An overview of work measurement techniques for sheltered workshops is presented, focusing on: (1) its conceptual framework, (2) expressing the results, (3) methods of setting production standards, (4) applications for work measurement, and (5) its usefulness as a tool in process evaluation, job placement, and for use with the modified production standards concept. Task definitions, time values, and worker definitions are taken into account. (AG)

ED 064 80

WORK MEASUREMENT IN REHABILITATION WORKSHOPS

By Ronald R. Stroud

TECHNICAL
MONOGRAPH
NO. 1

REGIONAL REHABILITATION RESEARCH INSTITUTE
DEPARTMENT OF INDUSTRIAL EDUCATION
UNIVERSITY OF MARYLAND
COLLEGE PARK, MARYLAND

VT017 514

ED 069880

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

WORK MEASUREMENT IN REHABILITATION WORKSHOPS

By Ronald R. Stroud

TECHNICAL MONOGRAPH NO. 1

Edited by Auburn J. Lamb

Regional Rehabilitation Research Institute
The University of Maryland
Jull Hall
College Park, Maryland 20742

This bulletin was supported in part by
Research Grant, RD-2040-G
from the
Social and Rehabilitation Service
Department of Health, Education and Welfare
Washington, D. C. 20201

1 9 7 0

This is a UMRRRI Production-Management Publication
Technical Series, Monograph No. 1

Published by

Regional Rehabilitation Research Institute
Jull Hall, University of Maryland
College Park, Maryland 20742

1970

S t a f f

Edmund D. Crosby	Project Director
Auburn J. Lamb	Research Director
Ronald R. Stroud	Assistant Research Director
Margaret B. Poling	Secretary

TABLE OF CONTENTS

		Page
PREFACE		v
SECTION		
I.	INTRODUCTION TO WORK MEASUREMENT	1
II.	AN OVERVIEW OF WORK MEASUREMENT	3
	Universally Accepted Techniques	3
	Qualified, Competent Worker	4
	Prescribed Task	4
	CONCEPTUAL FRAMEWORK OF WORK MEASUREMENT	5
	EXPRESSING THE RESULTS	5
	Standard Time	6
	Production Standard	6
	Piece Rate	6
	METHODS OF SETTING PRODUCTION STANDARDS	7
	Past Performance Records	7
	Supervisor's Estimate	7
	Customer's Opinion	8
	Stopwatch Time Study and Standard Time Data	8
	Predetermined Motion Time Systems (PMTS)	8
	Work Sampling	8
	APPLICATION FOR WORK MEASUREMENT	9
	Labor Costs	9
	Method Selection	10
	Production Scheduling	11
	Performance Level	12
	Manpower Forecasting	12
	Incentive Wages	13
	Justification of Client Wages to the Department of Labor	13
III.	WORK MEASUREMENT IN REHABILITATION	14
	AN EVALUATION TOOL	14
	A PLACEMENT TOOL	14
	MODIFIED PRODUCTION STANDARDS CONCEPT	15
SUMMARY		18

OTHER UMRRRI PRODUCTION MANAGEMENT PUBLICATIONS

Survey Report:

1. *"The Regional Rehabilitation Research Institute at the University of Maryland." A report on the survey of 254 sheltered workshops, 1966-67.

Technical Bulletins:

1. Industrial Illumination, staff written, April 1968.
2. Collating in Sheltered Workshops, by Daniel D. Mauchline, and Ronald R. Stroud, April 1968.

Information Bulletins:

1. Description of the Regional Rehabilitation Research Institute: Plans for the Future, staff written, January, 1967.
2. Subcontracting on Defense Work, staff written, March 1967.
3. Equipment Exchange Program, staff written, May 1967.
4. An Introduction to N/C Machines for Sheltered Workshop Directors, by Clifton P. Campbell, ed., Auburn J. Lamb, November 1969.

Preliminary Report:

1. The Reliability of Work Evaluation Made after One Day Compared to Ratings Made after Thirty Days, by Mark M. Smith, ed., Auburn J. Lamb, November 1969.

Newsletters, Quarterly:

1. Region III R&T Newsletter, staff written, October 1969, Vol. 1, No. 1.
2. Region III R&T Newsletter, ed., Auburn J. Lamb, February 1970, Vol. 2, No. 1.

---

*Out of print.

P R E F A C E

The Vocational Rehabilitation Research and Demonstration Grant Program of the Social and Rehabilitation Service, U. S. Department of Health, Education, and Welfare (HEW) supports a research institute in each of the regions of the department as a facility for scientific studies in rehabilitation. The basic purposes of these institutes have been defined as follows:

1. To develop a program of core research in an area important to vocational rehabilitation.

2. To stimulate state rehabilitation agencies to become curious about their operational problems which might be subject to research and to provide consultation to such state agencies.

3. To participate in the conduct of operational research at the request of the state DVR agencies, after clearance with the federal office in Washington, D. C.

In HEW Region III, the Regional Rehabilitation Research Institute (RRRI) was established at the University of Maryland in September 1966, for a program of core research on production-management aspects of sheltered workshops.

In partial fulfillment of its goals, the Region III Rehabilitation Research Institute has, with this monograph, begun the publication of a series on production-management. This endeavor was prompted because a search for written material on production-management as it relates to rehabilitation, has revealed that such material is in short supply. However, there are special books available on specific aspects of production-management for industry, and it is in this area that the Institute has proceeded to assist in making knowledge available. Selected techniques used by industrial profit-making enterprises of value to workshops are described, and suggestions are made to point the way for their use in rehabilitation workshops.

This technical monograph, No. 1, Work Measurement in Rehabilitation Workshops, by Ronald R. Stroud, is the first in a series of short, easy-to-read, practical articles which will be published by the Institute. Mr. Stroud, author of this monograph, has been the Assistant Research Director of the Regional Rehabilitation Research Institute (RRRI) at the University of Maryland since February 1967. He joined the Institute

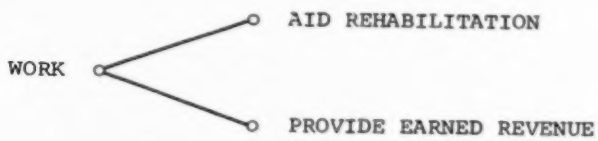
staff after responsible and extensive industrial experience. Through numerous visitations to sheltered workshops and consultations with their directors and managers, he has gained an appreciation for,and an insight into the production problems which plague them. Hopefully, the answers to many of the perplexing problems will be found in the Institute's technical monograph series, beginning with this problem by Mr. Stroud, which will be the initial monograph, No. 1., of three devoted to work measurement.

A J L

SECTION I

INTRODUCTION TO WORK MEASUREMENT

The application of formal work measurement systems to rehabilitation workshops poses unusual and difficult problems not normally encountered in competitive, profit-making organizations. In order of magnitude, the largest problem in applying work measurement originates from the very nature of the workshop's rehabilitation process--the integration of an economic entity and a rehabilitation service. Therefore, the workshop, particularly the smaller workshop with less than fifty clients and largely dependent on contract work to meet the payroll and operating expenses, has two major objectives: (1) to use work to aid in the rehabilitation of clients; and (2) to derive as much earned revenue as possible through the use of work.



Often these objectives conflict. However, when the objectives are put into proper perspective, they complement one another well. The two conflict when financial pressures for increased contract revenues exert production pressures on the client which are not conducive to the rehabilitation process. On the other hand, the conflict also occurs when too little pressure or emphasis is placed on worker, or client, productivity.

From both a rehabilitation point of view, and a workshop managerial aspect, the objectives become complementary when realistic production goals are established. Sound work measurement techniques can assist the workshop to meet the rehabilitation and economic objectives.

Unlike profit-making enterprises, workshops, particularly the smaller ones, are often involved in a wide variety of contract work which has little or no similarity. Under these conditions, it is difficult for the workshop manager, or supervisor to set up the job in an optimally efficient manner or to be able to accurately forecast production costs and schedules. Another problem in applying work measurement to reha-

bilitation workshops is that many contracts are of short duration lasting from several days to several weeks. In each of these situations, conventional stopwatch time study often loses its practicality. Short range work contracts cannot normally justify extensive time studies. A workshop is frequently asked to bid on a contract in which little or no experience exists for that particular kind of work. In such cases, the workshop must either quote a "guesstimate" or time workshop staff members in order to obtain an estimate of time requirements.

Fortunately, stopwatch time study is not the only means of measuring work. The use of "predetermined motion time systems" offer much promise in solving these measurement problems. "Work sampling" is another technique; which is particularly advantageous for determining time requirements of work activities which do not follow a uniform or prescribed pattern, such as clerical work, and materials handling.

Industry has become quite sophisticated in its approach to measuring work. A high degree of sophistication in work measurement techniques is desirable and frequently necessary whenever a company is engaged in high volume production of similar product lines year after year, particularly when the competition for markets is rigorous. Sophistication is desirable also whenever workers are represented by organized labor. For the welfare of its members, unions insist that work measurement be conducted accurately to insure equitable production standards. These highly refined work measurement techniques, however, are essentially offshoots from the three basic types (time study, predetermined motion time systems and work sampling). The major differences are the method in which the time data are observed and recorded, and the analyses of the results. For example, an operation may be time studied with a special motion picture camera equipped with an elapsed timer instead of being directly observed and timed with a stopwatch. Work sampling can also be accomplished with a motion picture camera which takes pictures at random time intervals.

Sheltered workshops are not represented by organized labor and, not too many of them are engaged in continuous high volume production. For these reasons, the discussion on work measurement in this monograph and two subsequent monographs, is confined to the three basic techniques.

SECTION II

AN OVERVIEW OF WORK MEASUREMENT

Work measurement is the application of universally accepted techniques to a work situation in order to determine the length of time required for a qualified, competent worker to accomplish a prescribed task in a given situation. This definition includes several key phrases which need to be defined before one can really grasp the meaning of work measurement. These are:

1. universally accepted techniques
2. qualified, competent worker
3. prescribed task
4. given situation

Universally Accepted Techniques

The person practicing work measurement is fully knowledgeable of the particular system being used, whether it be conventional time study, predetermined motion time systems or work sampling. He is aware of the techniques which will yield the most accurate results. These techniques have become standardized by practitioners over the years and are equally applicable in most industries and businesses in any part of the world.

Qualified, Competent Worker

The length of time required to perform a task is established so that the "average" or "normal" worker can perform the task in the established time. The terms average, or normal, are relevant only in the respect that they imply a normal or average worker falls somewhere between the poor and excellent worker. Of course, poor, average, and excellent vary from company to company and industry to industry. For example, an employee rated as excellent in Company A may be rated as only average in Company B which pays a higher wage for a similar position.

It is acceptable then to refer to an average production worker, in terms of efficiency, as long as the work group or company is identified. Time requirements for each unit of

production are usually established to accommodate the average worker and to insure that approximately 95 percent of the group can perform the task in the time specified.

Sheltered workshops must operate somewhat differently, however. Because they must charge competitive prices for contract work, as specified by the Department of Labor, the price of direct labor must be based on prevailing wage rates in the community. This means, then, that in the workshop the average time established to complete a task must be reflective of the average time taken by the qualified, competent worker employed in private enterprise, and not the average time taken to complete a task in the workshop.

Aside from the Department of Labor regulations, there are two other reasons why the workshop should base time requirements on the industrial average rather than the workshop average.

1. It is more convenient to set a direct labor cost on the price of a work contract. Workshop productivity averages fluctuate greatly and are more widely dispersed than industrial averages.

2. The industrial productivity average serves as a gauge in revealing how well a client is progressing toward placement in a position in competitive employment. It shows to the client and to the workshop staff how well he measures up to his counterpart in private industry.

Prescribed Task

It is possible to perform the same task in a number of ways. Some of the ways are more efficient than others. Naturally, the task should be performed in the most efficient way to:

1. reduce fatigue

2. reduce the amount of time necessary to complete the task

Since different methods of performing the task require different amounts of time, the method of performing the job must be specified or defined for that particular production standard.

Given Situation

The working environment and conditions vary between jobs, between companies and between rehabilitation workshops. These variations must, therefore, be taken into account when deter-

mining the length of time to perform a task. Extremes in temperature and noise, for example, can result in a greater fatiguing effect than moderate noise and temperature levels. In addition, a worker's performance is affected by unavoidable delays. Waiting for materials to be processed and machine breakdown are other examples of situations which must be taken into consideration before allocating the time to perform the task.

CONCEPTUAL FRAMEWORK OF WORK MEASUREMENT

People everywhere, regardless of occupational class and level have a tendency to accomplish a task or carry out a responsibility in whatever time is provided. Professor C. Northcote Parkinson summarized this tendency very effectively in only a few words with Parkinson's First Law, which states, "Work expands to fill the time available for its completion." If a deadline is established, effort will be made to complete the work on time. Conversely, without a deadline, the time taken to complete the task could be indefinite. This natural tendency is known in the workshop field, and elsewhere as "stretching out the work." The practice becomes more prevalent when work contracts become scarce.

Practically everyone has this tendency and some sort of discipline must be established in order to provide a reasonable amount of time to complete a project. An executive, or supervisor, subjectively determines how long it will take to complete a project and then makes a notation of the deadline on his calendar. The contract vendor often makes this determination for the workshop and production must be scheduled to meet a definite deadline.

Up to this point, the time required to complete a task has been viewed as a deadline. Deadlines determine the time needed in which to complete a task measured in hours, days, weeks, months, and sometimes, even years. Work measurement is also concerned with deadlines on a smaller time interval. This time interval usually ranges from several seconds to several hours. These deadlines, which have been established through a particular technique are termed either time standards or production standards.

EXPRESSING THE RESULTS

Work measurement results in time data which may be expressed in a number of ways depending on how it is to be used:

1. Standard Time
2. Production Standard
3. Piece Rate

Standard Time

In any formal work measurement system the first data developed will be the standard time required to complete each product unit. This time reflects the total time necessary to complete the task, recover from the effects of fatigue, various time allowances caused by delays, maintaining equipment, and the personal time needed away from the job.

Standard time is usually expressed in one of two ways, in parts of a minute or in parts of an hour. It is more desirable to express this time in parts of an hour, to facilitate calculating man-hours, piece rates and the production standard. If a decimal minute stopwatch is used in a time study, the time must be converted to decimal hours.

> Example. After performing the time study and making the necessary adjustments, it is found that the individual times total 0.60 minutes, which is equivalent to 0.01 hours (decimal times). The 0.60 minutes or 0.01 hours is the standard time per unit.

The standard time can be used for other purposes without the necessity of further conversion, which will be discussed in the next section.

Production Standard

If it is desired to establish a production standard, the standard should be expressed in terms that everyone will immediately grasp, particularly the client. The production standard could be stated as the standard time, 0.01 hours per unit. However, this unit of measurement is not readily understood. It is more desirable to express the production standard as the number of units or pieces per hour. This is easily accomplished by dividing one hour by the standard hours:

$$\frac{1.00 \text{ hour}}{0.01 \text{ hour}} = 100$$

The production standard is 100 units per hour.

Piece Rate

The piece rate is even more comprehensible to the client than the production standard. If the client knows that a certain amount of pay is awarded for each unit of production, the benefits of additional effort are more tangible to him.

The piece rate is actually an incentive pay system, of offering both negative and positive rewards. Since the client is paid for only what is produced, his earnings can either be substantially below or slightly above the industrial wage rate

for the particular job being processed.

Piece rates are expressed as the amount of wage compensation for each unit of production. The renumeration is calculated by dividing the production standard into the hourly wage rate for performing similar work in the industrial or business community.

Example. The production standard is calculated to be 100 units per hour. The "going" wage rate for similar type work is $2.00 per hour.

$$\text{Piece Rate} = \frac{\text{Industrial wage rate}}{\text{Production standard}}$$

$$= \frac{\$2.00 \text{ per hour}}{100 \text{ units per hour}}$$

$$= \$0.02 \text{ per unit}$$

The piece rate may also be calculated using the industrial wage rate and standard hours.

$$\text{Piece Rate} = \$2.00 \times 0.01$$

$$= \$0.02 \text{ per unit}$$

METHODS OF SETTING PRODUCTION STANDARDS

There are numerous ways to establish production standards; however, some methods are more accurate than others. The following methods are currently used by both sheltered workshops and private businesses; however, they are not recommended for most situations because of certain inherent weaknesses.

Past Performance Records

The use of past performance records for setting production standards is undesirable for the following reasons:

1. They do not specify the method used in performing the job.

2. They merely reveal how much work was accomplished rather than how much work should have been accomplished.

Supervisor's Estimate

The supervisor's estimate is based on past experience from similar jobs. Since the estimate is determined from sub-

jective reasoning, it is probably only slightly better than a guess.

Customer's Opinion

It is sometimes a difficult decision in determining whether or not to use a customer's opinion. He will often state what he would like to see as the production standard, rather than what it actually should be, in order to receive a more favorable price for a contract. Other times, the production standard, as determined by the customer, is merely an estimate. However, if the workshop has experienced previous equitable business relations with the customer and his production standards have proven to be fair, or known to have been developed through work measurement, the workshop may consider applying the standards to their own operations. Before adopting his standards, the workshop must make certain that it uses the same production methods, otherwise the production standard is not valid.

There are more systematic and accurate ways to establish production standards other than those previously described. Whenever practical, it is recommended that the following methods be utilized.

Stopwatch Time Study and Standard Time Data

Conventional stopwatch time study is the oldest and still most frequently used method for setting production standards. This system depends on identifying elements of a work task, timing each element and making an evaluation of the times observed with respect to some concept of normal pace.

Standard time data are developed from numerous time studies by grouping, averaging and classifying similar work elements. Although standard time data cannot always be used to set a production standard, it provides a sound basis for estimating labor time and cost.

Predetermined Motion Time Systems (PMTS)

Predetermined Motion Time Systems seek to identify every conceivable body motion used in performing a work task and assigning a predetermined time value to that motion. The time values required for each motion are added in order to obtain the total task time.

Work Sampling

Work Sampling is a statistical technique of making a large number of observations of a work task over a period of time in order to determine the percentage of time spent on observed activities.

APPLICATIONS FOR WORK MEASUREMENT

Without the assistance work measurement affords, it would be difficult to exercise effective managerial control over industrial operations. Work measurement serves management in much the same way as the caliper or micrometer serves the machinist. Like physical measuring devices, however, its accuracy is largely dependent on the user's ability to apply the methods learned and to interpret the results. In short, work measurement will provide the "yardstick" for determining the time requirements for the completion of a task.

Once the time requirements are known, it will be relatively easy to perform the following:

1. Determine labor cost.
2. Select the best alternate method.
3. Schedule production.
4. Establish performance levels.
5. Forecast manpower requirements.
6. Establish incentive wages.
7. Justify client wages to the Department of Labor.

Labor Costs

Labor costs are divided into two groups, direct and indirect labor. Direct labor is defined as "work which is readily chargeable to or identifiable with a specific product."[1] Indirect labor is "work that is not direct labor which may be required by a product or service."[2] Direct labor costs are incurred when a worker is directly involved with adding value or changing the appearance of a product or service. Indirect labor costs are incurred when it becomes necessary to add auxiliary functions to expedite the production process, such as loading and unloading trucks, in-plant materials handling, etc.

Direct labor time can be readily measured through conventional work measurement systems. It is not always so easy to measure indirect labor for the following reasons:

---

[1]Robert L. Williams, ed., "Industrial Engineering Terminology Manual," reprinted from The Journal of Industrial Engineering, Nov.-Dec., 1965, Vol. XVI, No. 6.

[2]Ibid.

1. The worker does not usually spend all of his working hours on one job. If he is engaged in materials handling operations, for example, it is possible that his time may be spent supplying material for two or more jobs.

2. The worker's pattern of activity cannot be easily prescribed; therefore, his work does not always follow in a definite systematic pattern.

Indirect labor usually constitutes a much smaller amount of total time to complete a contract than direct labor. Therefore, indirect labor costs are relatively low compared to direct labor costs. Indirect labor may be estimated on the basis of the percentage of time spent on each contract.

Example. If a materials handler spends approximately 10 percent of his time on Job A, 25 percent on Job B, and the remaining 65 percent on Job C, each job should be charged with the percentage allocated to that job. If the materials handler were paid $2.00 per hour and worked eight hours per day, his total daily pay would be $16.00. Each job would be charged the following amounts:

Job A - 0.10 X $16.00 = $01.60

Job B - 0.25 X $16.00 = $04.00

Job C - 0.65 X $16.00 = $10.40

Indirect labor can be measured through extended time study or through the technique of work sampling (to be discussed in Monograph 3). Since indirect labor usually constitutes a small portion of the total labor cost and since numerous and different types of contracts may be processed in the course of a year in workshops, the application of a formal work measurement is impractical. When a particular contract is of long duration, or when a considerable amount of indirect labor is involved, an attempt should be made to accurately determine the amount of indirect time spent on the contract.

Since direct labor costs usually represent the largest single cost in processing a contract, an accurate determination should be made for this expenditure. When the normal length of time to complete each unit of production, the total number of units in the contract, and the hourly wage rate are all known, calculating the total direct labor costs is a relatively simple process.

Method Selection

Since there are many ways of accomplishing an identical

work task, it is often difficult to determine the most efficient method unless each of the methods are compared in terms of time values. This particularly is true when one of the alternate methods offers only a slight improvement over another method. Work measurement will reveal the most efficient method of performing a job when several alternate methods are available.

Production Scheduling

Scheduling is done for the future, never for the present. When the normal time required to complete each unit of production is known, a prediction can be made about how many workers are needed to complete a contract on a certain future date.

Many variables can affect the length of time to complete a contract. However, the time available is relatively constant, assuming that overtime work is not allocated. Available work time is expressed in man-hours. If a workshop has 25 clients working seven hours per day, then 175 man-hours of labor are available. All scheduling for contract delivery dates should reflect the man-hours of work available in order to fulfill the workshop's obligation of meeting delivery deadlines.

It was mentioned earlier that production standards are established so that the average worker could meet the standard and that the sheltered workshop should base its production standard on the industrial expectation. A scheduling problem is posed when the clients are not producing at the normal rate. The problem is relatively small, however, if adequate individual production records have been maintained and a production standard established for every contract. The following example will illustrate this point.

> A work contract is under consideration by the workshop, and a production standard of 100 units per hour has been established. The contract requires that 10,000 units be completed ten days from the time of awarding the contract. The question is: can the contract be completed within ten days, taking into consideration the number of man-hours available (more than likely, some of the clients are busy working on other contracts)? The total average man-hours required is determined as follows:
>
> 1. Determine total average man-hours required.
>
> Man-hours = standard hours/unit X quantity
> = 0.01 X 10,000
> = 100 man-hours
>
> Bear in mind that 100 average man-hours are re-

quired to complete 10,000 units of production. Since most workshop clients perform less efficiently, an adjustment must be made to derive the actual man-hours to complete the contract in the workshop. If production standards have been established for prior contracts and client's records maintained for each contract, it is possible to calculate an efficiency index for each client. For example, if a client produced an average of 40 units per hour when the production standard was 100 units per hour, his level of efficiency is 40 percent. The average of all clients' efficiencies will reveal the overall workshop level of efficiency

2. Adjust average man-hours to workshop man-hours.

$$\text{Workshop man-hours} = \frac{40\%}{100\%} :: \frac{100 \text{ man-hours}}{X \text{ man-hours}}$$

$$40X = 10{,}000$$
$$X = 250 \text{ hours}$$

Therefore, in order to complete a contract which normally requires 100 man-hours it would actually require 250 man-hours in a workshop with a work force efficiency average of 40 percent. Since the contract must be completed within ten days of its acceptance, 25 clients must be assigned to the job.

Performance Level

It was shown above how work measurement can be used to determine the individual client's level of efficiency. Knowing this makes it possible to obtain the efficiency level for that of the entire workshop, and this knowledge can then be used in scheduling work to meet contract delivery dates. Performance levels can also be used for other purposes. One particular benefit to rehabilitation is that performance levels can be used as an objective evaluation tool. (This concept will be explored in a subsequent monograph.)

Manpower Forecasting

In the discussion on production scheduling it was demonstrated by using a hypothetical illustration that 25 clients were needed in order to meet the ten-day delivery deadline. In addition to scheduling production, a manpower forecast was also being made.

Private industry uses the same basic technique for advanced manpower planning in order to coordinate the personnel recruitment program. In most sheltered workshop situations such advanced manpower planning is not necessary. However, if a workshop is in need of clients to process a large potential

contract, and offers a rehabilitation program which will serve the best interest of the client, the manpower forecast, as determined from time standards, might be an inducement for the state rehabilitation office to assign additional clients to the workshop.

Incentive Wages

Work measurement serves as the foundation for incorporating a fair wage payment plan in private business. There are many kinds of wage incentive systems in use today. However, with most of these systems, the worker always earns as a minimum, a certain hourly base wage regardless of his productivity. Usually only the base hourly wage is earned for productivity less than or equal to the production standard. Productivity greater than the production standard results in a bonus or incentive wage in addition to the base wage rate.

Sheltered workshops cannot afford to pay a base wage in accordance with the Federal Minimum Wage Law ($1.60 per hour) because client productivity may be substantially below the production standard. Therefore, a renumerative plan such as piece rate payment, which pays the worker in proportion to productivity, seems to be the best alternative. In those rare instances where a client is capable of exceeding the production standard he still benefits from the piece rate system, which rewards him for additional effort.

Justification of Client Wages to the Department of Labor

It was previously demonstrated that the establishment of production standards in ways other than the use of a formal work measurement system is very subjective and arbitrary. Before granting special certificates which excludes workshops from paying the federal minimum wage, the Department of Labor requires an agency to show that client wage payments are equitable. The justification to the Department of Labor for client wage payments becomes more acceptable if they are based on production standards established by a formal and recognized system of work measurement.

SECTION III

WORK MEASUREMENT IN REHABILITATION

The discussion on work measurement to this point has been primarily concerned with the subject as it applies to the "business" aspects of operating a sheltered workshop. Work measurement can also be advantageously applied to the rehabilitation program. It can become a part of the evaluation process, lend assistance during job placement, and serve as the criterion for the modified production standards concept.

AN EVALUATION TOOL

Many vocational evaluators will attest that work evaluation is a highly subjective assessment of a client's capabilities and potential, particularly when psychological testing cannot be used as a measuring instrument. Work measurement offers a means to objectively quantify certain characteristics about an individual although it cannot identify the source of trouble. For example, if a client's productivity is extremely low, it could be for a number of reasons: short attention span, low degree of manipulative ability, a serious physical disability, etc. While work measurement cannot isolate the causes of low productivity, it can show the client's productivity when he first enters the workshop and what, if any, improvements have been made during the rehabilitation process. Since individual productivity is strongly influenced by factors such as interpersonal relationships, and causes previously mentioned, an accurate assessment of a client's capacity for work can hardly be made without the use of reliable production standards. From a number of visitations over the past three years, it has been observed that far too many workshops use production standards based on the three methods mentioned in Section II, i.e., past performance records, supervisor's estimates, and customer's opinions.

A PLACEMENT TOOL

Employers like to have tangible evidence of an employee's capabilities. When attempting to place a client into competitive employment, his chances of successful placement would be greatly enhanced if production records were available to verify his level of productivity. Not only would the client's chances of successful placement be improved but the counselor

could be more confident of the client's success. This would also develop confidence in the client--his knowing that he was being measured by industrial standards while in the workshop.

MODIFIED PRODUCTION STANDARDS CONCEPT

In some cases, particularly with extended term employees, it is unlikely that they will attain and sustain the production standard based on normal performances. This striving for an unattainable goal may produce frustration which lowers a person's level of motivation and aspiration. In such cases, the standard can be modified for individual clients so that with a little extra effort, the modified one becomes attainable. It is important, however, that clients be able to occasionally "taste" success by reaching the production standard tailored for them.

The modified standard should not in any way negate or supplant the actual standard, since the actual one should be used for high producers, to aid in scheduling, figuring labor costs, etc. The real advantage to the modified standard is that it permits the client to achieve a goal which would otherwise be unattainable, with the result that this kind of success would encourage him to become motivated to produce more efficiently.

The modified production standard concept could best be implemented for each client by providing him with a graphic representation of his progress, such as the charts depicted in Figures 1 and 2 on pages 16 and 17, respectively.

The vertical axis of Figure 1 represents the efficiency level at which the client is working, 100 percent being the production standard. The horizontal axis represents days of the week for a four-week period. This time period can be extended to cover as many weeks as desirable.

Figure 2 shows a chart which has been completed for a client. On Monday of the first week, the client's average productivity was 25 percent of normal expectancy. An arbitrarily selected goal of 35 percent (modified production standard) was established for the client for the remainder of the week which was based on his first day's performance. On Wednesday the client exceeded his goal and was successful for the remainder of the week. The goal for the second week was arbitrarily set at 45 percent, the third week at 55 percent and the fourth week at 65 percent.

The increase in productivity, illustrated in Figure 2, may or may not be typical of a client while working under ideal rehabilitation conditions. It seems reasonable, however, to assume that when a client is given an attainable goal and

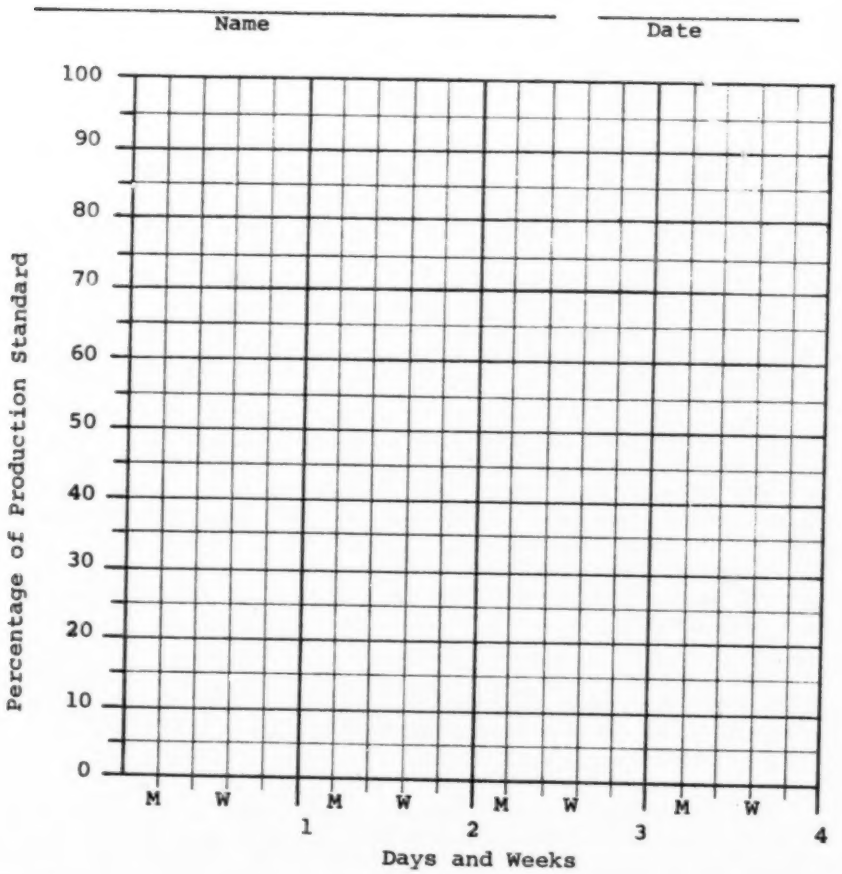


Figure 1. Individual Productivity and Motivation Chart.

then is provided with feedback which tells him where he is functioning in relation to that goal, he is more apt to become highly motivated in striving to reach it. Moreover, his individual chart will provide the supervisor or evaluator with an instant, objective summary of his work performance history. The chart should be posted in a location convenient for the client's review, and he should be encouraged to talk about it.

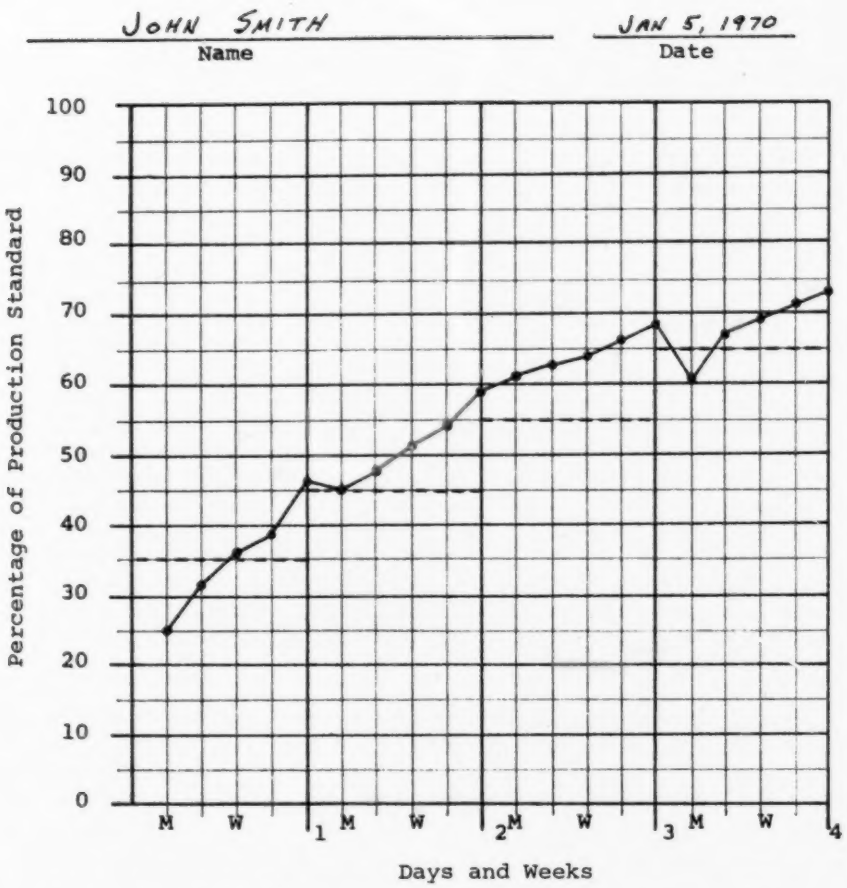


Figure 2. Individual Productivity and Motivation Chart.

Wage payments would continue to be paid in terms of the amount of work produced. For example, if the hourly wage rate for normal productivity were $2.00 per hour, the client would receive $0.50 per hour for each one worked on Monday of the first week, since his average level of productivity was 25 percent (.25 X $2.00 = $0.50). For Tuesday of the same week he would receive an average of $0.64 per hour (.32 X $2.00 = $0.64), and so on until he eventually reached his optimum level of productivity.

SUMMARY

The purpose of this monograph has been to provide a basic understanding of work measurement, what it can accomplish, and its application to both the rehabilitation and business functions of workshops. These workshops have a unique and difficult function in the respect that they play a dual, integrated role--that of a business with all of its economic problems, and, at the same time, provide a social service--that of rehabilitation. Work measurement can help solve some of the problems associated with both of these functions.

Work measurement consists of much more than merely clocking an operation to determine the time required to complete a task. It requires that a universally accepted work measurement technique be employed, and that the observed time to complete the task be adjusted to accommodate the qualified, competent worker, referred to as the "normal" worker. In determining this time value, the task must be prescribed or defined in order for the time values to be valid. The time values must also reflect the particular conditions under which the work is performed.

The usefulness of the study will be strengthened by the two subsequent publications to follow this one, which describe the mechanics of each of the three work measurement techniques: time study, predetermined motion time systems, and work sampling.